National Radio Astronomy Observatory
520 Edgemont Road
Charlottesville,VA 22903 USA
434.296.0211 Fax 434.296.0385
www.nrao.edu

Before the
FEDERAL COMMUNICATIONS COMMISSION
WASHINGTON, D.C. 20554

In the Matter of	)	
	)	
Petition to Modify Parts 2 and 101 of the Commission's Rules to Enable Timely Deployment of Fixed Stratospheric-Based Communications Services in the 21.5-23.6, 25.25-27.5, 71-76, and 81-86 GHz Bands	)	RM-11809

28 August 2018

Reply Comments
National Radio Astronomy Observatory

I. STRAPS or Still Just HAPS?

Elefante Group's continued argument, that a modest adjustment of the lower altitude bound of operation of their version of HAPS renders it other than HAPS, is not supportable. Elefante Group will operate under the fixed-satellite service, as for HAPS, and their K-band downlinks would use the same FSS satellite downlink spectrum being considered for HAPS. When discussing with Mexican, Canadian or Cuban regulatory authorities the visibility of Elefante Group's platforms within those administrations, the framework will be that of HAPS.

Moreover, interference from the Elefante Group's operations will aggregate with that from HAPS operators like Facebook and Loon who commented in reply to Elefante Group's Petition for Rulemaking, and these should all have the same service rules and be considered together when assessing compatibility with radio astronomy operations. In any case, they would share a common maximum allowance of 5% data loss to radio astronomy as noted in Section IV below.

II. Remoteness is no protection from HAPS that are visible for hundreds of miles and deployed over "urban deserts" and remote areas

In its reply, Elefante Group emphasized the remoteness of radio astronomy stations from large urban centers such as Greater Los Angeles, Palo Alto and Boston. Somewhat in contrast, NRAO noted in its original remarks that platforms over the smaller population centers El Paso, Las Cruces, Socorro, Albuquerque etc. would be visible at the Jansky Very Large Array (VLA) despite its remoteness from them. The Elefante Group should not put itself in the position of arguing against its own business model. If Elefante Group believes, as stated in their reply, that there is

a need for their service in "urban deserts" and rural areas, they must also recognize that the remoteness of radio astronomy stations from the very largest cities will not suffice to protect them.

III. Continued concerns of survivability

The in-band surface power flux density (pfd) levels for Elefante Group's K-band downlinks are near -110 dB W/m^2/MHz = -170 dBW/m^2/Hz = 10^9 Jy within the service area, the Jansky (Jy) being the unit of power flux density in which the brightness of cosmic radio sources is measured by radio astronomers. The most sensitive radio astronomical observations reach rms sensitivity levels measured in microJy.

As calculated under different assumptions by both NRAO and the Elefante Group in reply, power flux densities of -110 dB W/m^2/MHz could put ~ 0.1 mW into a radio astronomy receiver in the event that the radio telescope and a platform would point directly at each other. This is less than the burnout power levels cited in ITU-R Report RA.2188, but more than would suffice to permanently incapacitate the radio astronomy receiver. The presence of HAPS within direct line of sight presents an existential threat to radio astronomy operations as they are presently conducted, as discussed in more detail by NRAO in its first comment.

Although the likelihood of a destructive event increases with the number of platforms that are within line of sight, the received power of a destructive event should not aggregate in the manner described by the Elefante Group in reply Exhibit 4. These events occur when a radio telescope and HAPS platform directly point at each other, and the radio telescope will not directly point at more than one platform no matter how many platforms are pointing at the radio telescope. Perhaps related in this context, NRAO notes that the half-power beam width of an antenna with 88 dBi gain is about 0.5', a factor ~100 times smaller than the value 0.8^o that is given in Table 1 of Exhibit 4 in the Elefante Group's reply.

IV. Single Network and Aggregate interference

In its original comment, NRAO noted that the radio astronomy protection power flux density level proposed by the Elefante Group was 10 dB above that being considered at the ITU-R based on aggregate interference and a robust build-out of HAPS service. To some extent this occurs because the extremely optimistic levels of out of band attenuation assumed by Elefante Group for their operations (75 – 90 dB) are not used in ITU-R studies. But a full buildout of HAPS should also be considered in this proceeding if it is allowed.

In Table 3 of Exhibit 4, Elefante Group cites a 5% 'interference allocation'[1] from ITU-R Recommendation RA. 1513 in all scenarios involving more than one platform. The *recommends*

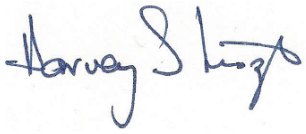
[1] As if interference were allocated in the same manner as radio spectrum itself. But the relevant *recommends* of RA. 1513 concern data loss to radio astronomy and are:

1 that, for evaluation of interference, a criterion of 5% be used for the aggregate data loss to the RAS due to interference from all networks, in any frequency band allocated to the RAS on a primary basis, noting that further studies of the apportionment between different networks are required;

of ITU-R Recommendation RA.1513 state that a spectrum band allocated to radio astronomy on a primary basis should be subject to no more than 2% data loss from any one *network* (ie all of Elefante Group's operations, not one platform) with a maximum of 5% from all networks taken together. So, if the platforms in question are operated by Elefante Group, at most 2% data loss should be considered no matter how many platforms there are. And if Elefante Group, Facebook and Loon and their competitors each operate HAPS networks, they cannot each be granted a 2% data loss exception, no matter what acronym they use to describe themselves.

Although the spectrum band 23.6 – 24 GHz is being treated as an "ordinary" primary allocation, it is of special importance to radio astronomy and remote sensing because it is not shared with active services. This should be remembered when making service rules.

Respectfully submitted,



Harvey S. Liszt (hliszt@nrao.edu)
Astronomer and Spectrum Manager
To whom correspondence may be addressed

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2 that, for evaluation of interference, a criterion of 2% be used for data loss to the RAS due to interference from any one network, in any frequency band, which is allocated to the RAS on a primary basis;